## Claims

[c1] 1. A reinforced superconducting tape, comprising:
a superconducting tape comprising a superconducting ceramic material;
a first metal reinforcing layer having a greater coefficient of thermal expansion than that of the superconducting tape; and
a second metal reinforcing layer having a greater modulus of elasticity than the superconducting tape and the first reinforcing layer.

[c2] 2. The tape of claim 1, wherein the superconducting tape comprises one or more ceramic superconductor filaments located in a noble metal sheath.

[c3] 3. The tape of claim 2, wherein the first reinforcing layer places the superconducting tape under compression due to its greater coefficient of thermal expansion.

[c4] 4. The tape of claim 3, wherein the value of the coefficient of thermal expansion of the first reinforcing layer is at least 10 percent greater than the value of the coefficient of thermal expansion of the sheath of the superconducting tape.

[c5] 5. The tape of claim 4, wherein the second reinforcing layer material has a modulus of elasticity value that is at least 100 percent greater than the modulus of elasticity value of the superconducting tape and the first reinforcing layer.

[c6] 6. The tape of claim 5, wherein:
the ceramic superconductor filaments comprise a plurality of filaments selected from a group consisting of BSCCO 2223, BSCCO 2212, and YBCO 123;
the sheath comprises at least one of gold, silver, silver alloy and oxide dispersion strengthened silver;
the first reinforcing layer is selected from a group consisting of aluminum, aluminum alloys, bronze, brass, lead, lead alloys, magnesium, magnesium alloys, tin, tin alloys, zinc and zinc alloys; and
the second reinforcing layer is selected from a group consisting of stainless steel, tungsten, rhodium, rhenium, cobalt, nickel, molybdenum, chromium and their alloys.

[c7] 7. The tape of claim 6, wherein:
the first reinforcing layer comprises aluminum;
the second reinforcing layer comprises stainless steel; and
the sheath comprises one or more of silver, silver alloy and oxide dispersion strengthened

silver.

[c8] 8. The tape of claim 1, wherein the first reinforcing layer, the second reinforcing layer and superconducting tape are laminated with a bonding agent.

[c9] 9. The tape of claim 8, wherein the bonding agent comprises epoxy or solder located between the superconducting tape and the first reinforcing layer and between the first reinforcing layer and the second reinforcing layer.

[c10] 10. The tape of claim 1, wherein at least one of the first and the second reinforcing layers is directly deposited on the superconducting tape.

[c11] 11. The tape of claim 10, wherein the first reinforcing layer is directly deposited on the superconducting tape, and the second reinforcing layer is formed on the first reinforcing layer.

[c12] 12. The tape of claim 1, wherein:
the first reinforcing layer is formed over a first side of the superconducting tape; and
the second reinforcing layer is formed over a second side of the superconducting tape.

[c13] 13. The tape of claim 1, wherein:
the first reinforcing layer is formed over a first side of the superconducting tape; and
the second reinforcing layer is formed over a first side of the first reinforcing layer.

[c14] 14. The tape of claim 1, wherein:
a first portion of the first reinforcing layer is formed over a first side of the superconducting tape and a second portion of the first reinforcing layer is formed over a second side of the superconducting tape; and
a first portion of the second reinforcing layer is formed over the first portion of the first reinforcing layer and a second portion of the second reinforcing layer is formed over the second portion of the first reinforcing layer.

[c15] 15. The tape of claim 1, wherein:
a first portion of the first reinforcing layer is formed over a first side of the superconducting tape and a second portion of the first reinforcing layer is formed over a second side of the superconducting tape; and
the second reinforcing layer is formed over the first portion of the first reinforcing layer.

[c16] 16. The tape of claim 1, wherein:
the first reinforcing layer is formed over every side of the superconducting tape; and
the second reinforcing layer is formed over every side of the first reinforcing layer.

[c17] 17. The tape of claim 1, wherein:
the first reinforcing layer is directly deposited on every side of the superconducting tape; and
the second reinforcing layer is laminated to a first side of the first reinforcing layer.

[c18] 18. The tape of claim 1, wherein the reinforced superconducting tape is formed into a coil.

[c19] 19. The tape of claim 1, wherein the reinforced superconducting tape is located in a generator, a motor, a transformer, a magnetic resonance imaging system (MRI) magnet, a magnetic separation device, a power transmission cable or a fault current limiter.

[c20] 20. The tape of claim 19, wherein the reinforced superconducting tape coil is wound around a rotor core of a generator which comprises a rotor comprising the rotor core and a stator comprising stator coils.

[c21] 21. An electric machine, comprising:
a stator comprising stator coils;
a rotor comprising a rotor core; and
a coil winding around the rotor core, the coil winding comprising:
a superconducting tape comprising one or more ceramic superconductor filaments located in a noble metal sheath;
a first metal reinforcing layer having a greater coefficient of thermal expansion than that of the superconducting tape; and
a second metal reinforcing layer having a greater modulus of elasticity than the superconducting tape and the first reinforcing layer.

[c22] 22. The machine of claim 21, wherein:
the value of the coefficient of thermal expansion of the first reinforcing layer is at least 10 percent greater than the value of the coefficient of thermal expansion of the sheath of the superconducting tape, such that the first reinforcing layer places the superconducting tape under compression due to its greater coefficient of thermal expansion; and
the second reinforcing layer material has a modulus of elasticity value that is at least 100 percent greater than the modulus of elasticity value of the superconducting tape and the

first reinforcing layer.

[c23] 23. The machine of claim 22, wherein:
the ceramic superconductor filaments comprise a plurality of filaments selected from a group consisting of BSCCO 2223, BSCCO 2212, and YBCO 123;
the sheath comprises at least one of gold, silver, silver alloy and oxide dispersion strengthened silver;
the first reinforcing layer is selected from a group consisting of aluminum, aluminum alloys, bronze, brass, lead, lead alloys, magnesium, magnesium alloys, tin, tin alloys, zinc and zinc alloys; and
the second reinforcing layer is selected from a group consisting of stainless steel, tungsten, rhodium, rhenium, cobalt, nickel, molybdenum, chromium and their alloys.

[c24] 24. The machine of claim 21, wherein:
the electric machine comprises a generator; and
the coil winding is racetrack shaped.

[c25] 25. The machine of claim 24, further comprising:
a cryogen fluid passage formed around the coil winding; and
electric contacts connected to the coil winding.

[c26] 26. A method of making a reinforced superconducting tape, comprising:
providing a superconducting tape comprising a superconducting ceramic material;
forming a first metal reinforcing layer having a greater coefficient of thermal expansion than that of the superconducting tape; and
forming a second metal reinforcing layer having a greater modulus of elasticity than the superconducting tape and the first reinforcing layer.

[c27] 27. The method of claim 26, wherein:
the superconducting tape comprises one or more ceramic superconductor filaments located in a noble metal sheath;
the value of the coefficient of thermal expansion of the first reinforcing layer is at least 10 percent greater than the value of the coefficient of thermal expansion of the sheath of the superconducting tape, such that the first reinforcing layer places the superconducting tape under compression due to its greater coefficient of thermal expansion; and
the second reinforcing layer material has a modulus of elasticity value that is at least 100

percent greater than the modulus of elasticity value of the superconducting tape and the first reinforcing layer.

[c28] 28. The method of claim 27, wherein the step of providing the superconducting tape comprises:

packing a ceramic precursor powder into a noble metal billet; drawing the billet to form a monofilamentary wire;

cutting the wire into multiple pieces;

rebundling the wire pieces into at least one noble metal tube to form a multifilamentary wire;

drawing the multifilamentary wire;

rolling the drawn multifilamentary wire into a tape; and

heat treating the tape to convert the ceramic precursor powder into ceramic superconductor filaments, such that the billet and the at least one tube form a sheath portion of the tape and the ceramic filaments form a superconducting portion of the tape.

[c29] 29. The method of claim 28, wherein:

the ceramic superconductor filaments comprise a plurality of filaments selected from a group consisting of BSCCO 2223, BSCCO 2212, and YBCO 123;

the sheath comprises at least one of gold, silver, silver alloy and oxide dispersion strengthened silver;

the first reinforcing layer is selected from a group consisting of aluminum, aluminum alloys, bronze, brass, lead, lead alloys, magnesium, magnesium alloys, tin, tin alloys, zinc and zinc alloys; and

the second reinforcing layer is selected from a group consisting of stainless steel, tungsten, rhodium, rhenium, cobalt, nickel, molybdenum, chromium and their alloys.

[c30]

30. The method of claim 26, further comprising:

forming a bonding agent over at least a first side of the superconducting tape;

forming one of the first reinforcing layer and the second reinforcing layer on the bonding agent located on at least the first side of the superconducting tape;

forming a bonding agent over at least one of a second side of the superconducting tape and the reinforcing layer formed over the first side of the superconducting tape; and

forming the other one of the first reinforcing layer and the second reinforcing layer on the bonding agent located on the at least the second side of the superconducting tape or on the

formed reinforcing layer.

[c31] 31. The method of claim 30, wherein:
the first reinforcing layer is formed on the bonding agent located on at least the first side of the superconducting tape; and
the second reinforcing layer is formed on the bonding agent located on the second side of the superconducting tape.

[c32] 32. The method of claim 30, wherein
the first reinforcing layer is formed on the bonding agent located on at least the first side of the superconducting tape; and
the second reinforcing layer is formed on the bonding agent located on the first reinforcing layer.

[c33] 33. The method of claim 26, further comprising directly depositing at least one of the first and the second reinforcing layers on the superconducting tape.

[c34] 34. The method of claim 33, wherein the at least one of the first and the second reinforcing layers is directly deposited on the superconducting tape by electroless plating, electroplating, hot dip coating, thermal spray coating, evaporation, ion plating, sputtering, chemical vapor deposition or solid source diffusion.

[c35] 35. The method of claim 34, wherein:
the first reinforcing layer is formed on the superconducting tape by electroless plating, electroplating or hot dip coating; and
the second reinforcing layer is directly deposited on the first reinforcing layer or is laminated to the first reinforcing layer.

[c36] 36. The method of claim 26, further comprising placing the reinforced superconducting tape into a generator, a motor, a transformer, a magnetic resonance imaging system (MRI) magnet, a magnetic separation device, a power transmission cable or a fault current limiter.

[c37] 37. The method of claim 36, further comprising:
mounting a generator rotor core onto a winding hub of a take up roll;
spooling the reinforced superconducting tape from a payoff roll around the rotor core to form a racetrack shaped coil winding;
attaching a cryogen cooling passage around the coil winding; and

placing the rotor core, the coil winding and the cooling passage into a rotor cavity located in a stator of a generator.